## Homework Assignment #4 Due: October 27, 2016 at 1:00 p.m.

- 1. Consider a synchronous message-passing system where all processes know the network graph G. Up to f of the processes may experience halting failures. Moreover, Dr Evil has been lurking around and might take over one of the processes and make it behave in his characteristically evil way. A process is called correct in an execution if it does not fail and is not taken over by Dr Evil. Give a necessary and sufficient condition on G to make it possible to solve consensus satisfying
  - termination: every correct process eventually produces an output,
  - **agreement**: every output (except the one produced by Dr Evil's process) is the same, and
  - validity: if every process (except the one controlled by Dr Evil) has input v then every correct process outputs v.

Prove your answer is correct. Such a proof should include

- (a) a description of how to build an algorithm for any graph G that satisfies your condition,
- (b) an explanation of why that algorithm satisfies termination, agreement and validity, and
- (c) a proof that consensus is impossible in any graph G that does not satisfy your condition.